

### Notice of Allowability

Application No.

10/009,094

Examiner

Rip A. Lee

Applicant(s)

SOGA ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to November 25, 2003.
2. ☒ The allowed claim(s) is/are 2-4 and 6-22.
3. ☒ The drawings filed on November 8, 2001 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☐ All b) ☐ Some\* c) ☐ None of the:
    1. ☐ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
  - \* Certified copies not received: \_\_\_\_\_.
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
  - (a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE**

7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
  - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
    - 1) ☐ hereto or 2) ☐ to Paper No. \_\_\_\_\_.
  - (b) ☐ including changes required by the proposed drawing correction filed \_\_\_\_\_, which has been approved by the Examiner.
  - (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the margin according to 37 CFR 1.121(d).

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

#### Attachment(s)

- |  |   |
|--|---|
| 1 <input type="checkbox"/> Notice of References Cited (PTO-892)  | 5 <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)          |
| 2 <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                     | 6 <input type="checkbox"/> Interview Summary (PTO-413), Paper No. _____             |
| 3 <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No. _____  | 7 <input type="checkbox"/> Examiner's Amendment/Comment                             |
| 4 <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | 8 <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
|  | 9 <input type="checkbox"/> Other  |

### DETAILED ACTION

This office action follows an after final amendment filed on November 25, 2003. Applicants have canceled claims 1 and 5. Claims 3, 4, 7, 14, 15, and 18-22 were amended to correct matters of form.

#### *Allowable Subject Matter*

The following is an examiner's statement of reasons for allowance: Claims 2-4 and 6-22 are allowed over the closest references, Hagihara *et al.* (*Macromolecules* 1998), U.S. Patent No. 5,391,629 to Turner *et al.*, and JP 2001-81123.

The present invention relates to processes for preparing olefinic living polymers comprising polymerizing an olefinic monomer having 2 to 20 carbon atoms at a polymerization temperature of -20 to -100 °C in the presence of a particular catalyst. In one embodiment, the catalyst is comprised of a hafnium-containing compound having one or two cyclopentadienyl ligands, a borane of formula  $BPh_3$ , and an aluminum compound of formula  $AlR_{3-n}Y_n$ . In a second embodiment, the catalyst is comprised of a zirconium-containing compound having one or two cyclopentadienyl ligands, and the polymerization occurs at -60 to -100 °C instead. In both processes, the resulting polymers have a molecular weight distribution  $M_w/M_n$  of 1 to 1.3.

A third aspect of the invention relates to polymerization in the presence of a catalyst comprising a zirconium-containing compound having one or two cyclopentadienyl ligands, a borane  $BPh_3$  or borate  $BPh_4X$ , and a titanium-containing compound. The last embodiment of the invention is drawn to polymerization with a catalyst comprising all four components: a

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zirconium-containing compound, borane or borate, aluminum compound, and titanium-containing compound.

While living polymerization systems have been reported using catalysts containing non-metallocene based transition metal complexes, living polymerization systems using conventional metallocenes are less common.

Hagihara *et al.* teaches living polymerization of propene and 1-hexene with the catalyst prepared from  $[t\text{-BuNSiMe}_2\text{Flu}]\text{TiMe}_2/\text{B}(\text{C}_6\text{F}_5)_3$  between temperatures of  $-20$  to  $-100$  °C. The reference differs from the claimed invention in that use of an aluminum compound or a titanium compound in conjunction with the catalytic species is not discussed. Since the active catalyst, prepared *in situ*, was demonstrated to exhibit living polymerization characteristics, little motivation exists to modify an already working system by combining with an aluminum compound or titanium-containing compound. Therefore, the skilled artisan would not have found it obvious to modify the invention of Hagihara *et al.* to arrive at the subject matter of the present claims.

Turner *et al.* discloses a process for polymerization of olefins in the presence of a catalysts comprised of a cyclopentadienyl ligand group IVB metal component and a second component of a compatible non-coordinating anion to produce a first living polymer. The activated catalyst complex product is represented by the formula  $[\text{A-CpMX}_1(\text{L})][\text{B}(\text{C}_6\text{F}_5)_3(\text{X}_3)]$  wherein  $\text{X}_3$  is a hydride, halogen or hydrocarbyl radical, implying use of  $\text{B}(\text{C}_6\text{F}_5)_3$  as an activator. According to the inventors, polymerization may be carried out at any temperature within the range of  $-80$  to  $80$  °C.

The Turner *et al.* patent is deficient in that it does not teach use of a catalyst comprised of aluminum compound  $AlR_{3-n}Y_n$  or titanium-containing compound in addition to the primary transition metal complex and activator. Since the present catalyst system has been demonstrated to work successfully, little motivation exists to modify an already working system by combining with an aluminum compound or titanium-containing compound. Therefore, it is maintained that the skilled artisan would not have found it obvious to modify the teachings of Turner *et al.* to arrive at the subject matter of the present claims.

JP 2001-81123 teaches living polymerization of olefins at  $-20$  to  $-100$  °C in the presence of a catalyst system comprising a zirconium compound having one or two cyclopentadienyl ligands, a borane or borate, an aluminum compound  $AlR_{3-n}Y_n$  and a titanium-containing compound. Here, the living polymer is prepared first, followed by quenching by carbonylation agent, thereby resulting in the formation of a carbonyl terminus. The publication date of the reference (March 27, 2001) does not precede the foreign priority date (May 10, 1999) of the present application.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rip A. Lee whose telephone number is (703)306-0094. The examiner can be reached on Monday through Friday from 9:00 AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu, can be reached at (703)308-2450. The fax phone number for the organization where this application or proceeding is assigned is (703)746-7064. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661.

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December 11, 2003



DAVID W. WU  
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